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FLOOD INSURANCE STUDY

ORIGINAL

COMPLETED

23

VILLAGE OF HEBRON, OHIO

LICKING COUNTY

JUNE 15, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 390333

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY

VILLAGE OF HEBRON,
LICKING COUNTY, OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Village of Hebron, Licking County, Ohio, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the Village of Hebron to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Department of Agriculture, Soil Conservation Service (SCS) for the Federal Emergency Management Agency, under Inter-Agency Agreement No. I-AA-H-11-79, Project Order No. 3. This study was completed in March 1981.

1.3 Coordination

The first community meeting was held on November 17, 1978 and attended by representatives of the Village of Hebron, the Ohio Department of Natural Resources, FEMA, and the SCS. The nature and purpose of the Flood Insurance Study was explained and then study limits were determined. A notice announcing the study and stating its objectives appeared in the Newark Advocate on July 14, 1979.

The Ohio Department of Natural Resources served as the state-coordinating agency for this study. Representatives of the Village of Hebron and the SCS reviewed the proposed floodway and flood boundary information in a meeting on August 11, 1980.

The proposed discharge information was sent to local, state, and Federal agencies on June 10, 1980 with a request for review and comment. A response was received from the U.S. Geological Survey (USGS) and the U.S. Army Corps of Engineers (COE). Discharge values from the USGS and those proposed for this study were within an acceptable range of difference. The COE spot checked the flow values on the South Fork Licking River. The results are discussed in Section 3.1.

On January 20, 1982, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Village of Hebron, Licking County, Ohio. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction for the next five years, through March 1986.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by FEMA and the Village of Hebron.

The South Fork Licking River was studied in detail along the south village limits. An unnamed stream hereafter known as Hebron Tributary that flows through Hebron was studied in detail from the apartments south of the ball field on Cumberland Street to the downstream village limits on the east side. The remaining areas all have less than one square mile drainage area; therefore, they were studied by approximate methods.

2.2 Community Description

The Village of Hebron is located in central Ohio approximately 30 miles east of downtown Columbus, Ohio. Surrounded on all sides by unincorporated Licking County, the Village of Hebron is located near the south boundary of Licking County approximately halfway between the east and west boundaries. Hebron's population increased from 1,699 in 1970 to 2,036 in 1980 (Reference 1).

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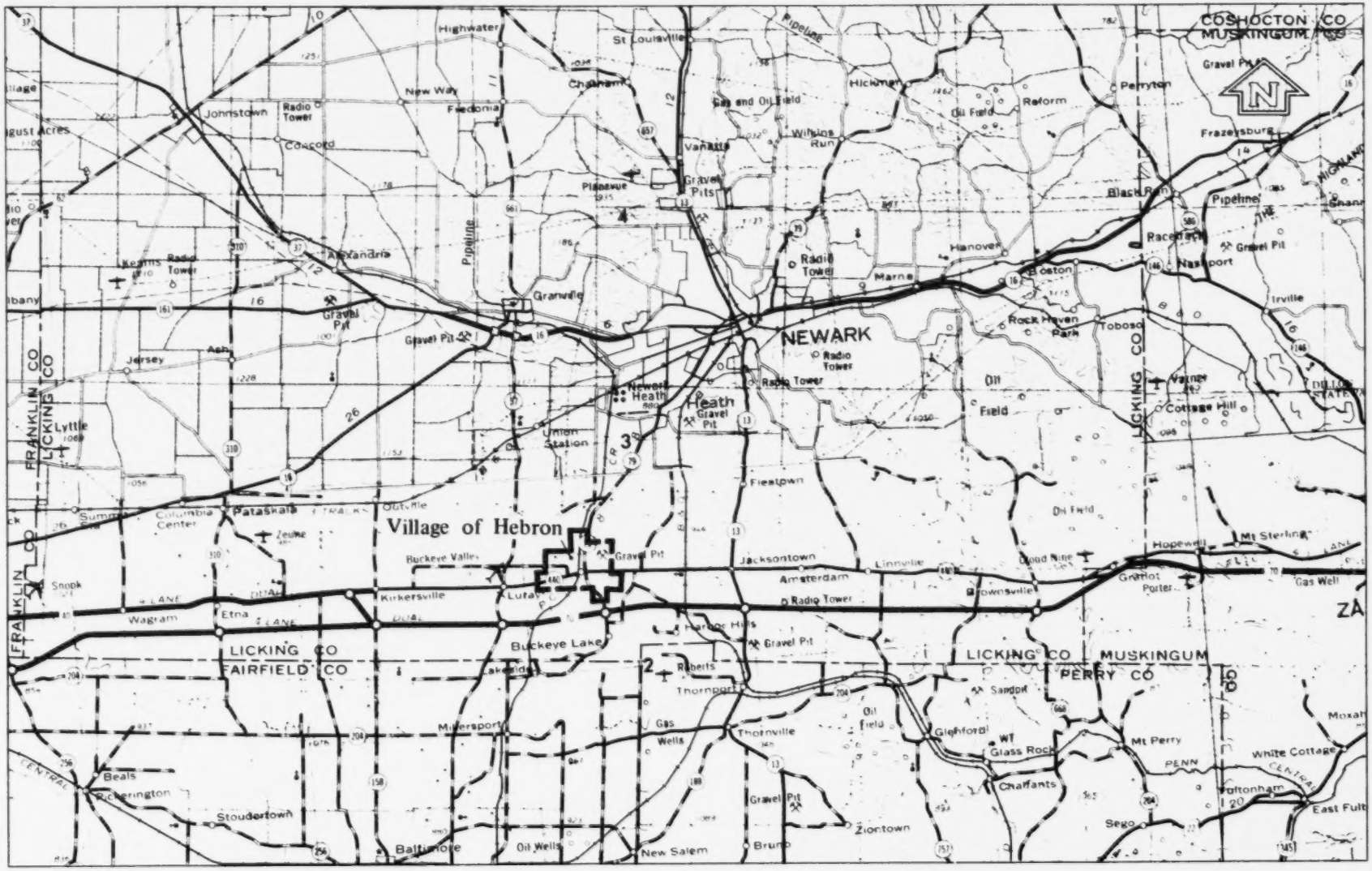

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF HEBRON, OH
(LICKING CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

The climate is temperate with relatively cool to cold winters and mild to warm summers. Average annual precipitation is approximately 39 inches and is distributed unevenly, producing a dry harvest season during late summer and early fall. Average monthly temperatures range from 30-40 degrees Fahrenheit (F.) in January to 70-80 degrees F. in July. The nearly level soils that flood in Hebron are not commonly considered floodprone; however, they do occupy a low position on the landscape and are subject to flooding.

Some commercial development has occurred in floodprone areas near the center of the village. There is some residential development in most of the floodprone areas in the village.

2.3 Principal Flood Problems

Flooding occurred in the Village of Hebron on September 14, 1979. A flood of this magnitude would be expected to be equalled or exceeded once in 20 years on the average. Some homes in the southern part of Hebron were flooded from the South Fork Licking River. Flooding also caused damage to the village hall, a travel trailer, lawns and streets. The majority of major floods have occurred during the spring and are usually the result of generally heavy rainfall.

A similar flood occurred in the Village of Hebron in January 1959 (Reference 2). Other serious floods occurred in 1898, 1913, 1964, 1968 and 1975.

Shallow flooding, less than two feet deep, occurs over a large part of the west side of the village.

2.4 Flood Protection Measures

A watershed plan for flood damage reduction in the watershed has been developed by the South Fork Licking River Watershed Conservancy District with the assistance of the U.S. Department of Agriculture (Reference 3). Installation of the planned project will reduce flooding in the Village of Hebron from the South Fork Licking River west of State Route 79. This project, however, is not part of the analysis for this study.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 per cent

chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one per cent chance of annual occurrence) in any 50-year period is about 40 per cent (four in ten), and for any 90-year period, the risk increases to about 60 per cent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

The discharge-frequency information for the South Fork Licking River was developed for the South Fork Licking River Watershed Plan through the use of the SCS TR-20 computer program (Reference 4). This program uses information on the characteristics of the watershed such as soil type, slope, vegetation and land use to predict flows resulting from given runoff events. These values were used for the Village of Hebron Flood Insurance Study. The COE spot checked the proposed discharges on the South Fork Licking River near the Village of Hebron. The COE values were higher than the SCS values as expected. Due to the shape of the watershed, the width and flatness of the flood plain, one would expect lower flows from an actual watershed model than from a regionalized calculation. Discharge frequency information for Hebron Tributary was developed using the regression equations in Bulletin No. 45, "Floods in Ohio" (Reference 5). Input to the equations was drainage area and main channel slope. Since Bulletin No. 45 does not contain prediction equations for the 500-year frequency storm, this value was obtained by extrapolating on log-probability paper from the other frequency values (Reference 6).

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
HEBRON TRIBUTARY					
At mouth	2.4	390	630	750	1,070
SOUTH FORK LICKING RIVER					
At State Route 79	89.3	3,110	4,370	4,920	6,280

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Flood elevations of the detailed study areas were estimated through use of the SCS computer program WSP-2 (Reference 7). The program utilizes the standard step method to compute water-surface elevations. Cross sections were obtained by field surveys using transit-stadia methods.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map.

Manning's "n" values were estimated visually on location. On the South Fork Licking River, the "n" values were 0.045 for the channel and 0.100 for the flood plain. The "n" values for Hebron Tributary were 0.040 to 0.070 for the channel and from 0.050 to 0.120 for the flood plain. The reach lengths, distance between sections, were measured from USGS quadrangle maps. The values for the South Fork Licking River had been previously determined for the "South Fork Licking River Watershed Plan" (Reference 3) and used in this study. Starting elevations for the South Fork Licking River were taken from the water-surface profiles run for the Licking County Flood Insurance Study (Reference 8). Normal depth was used for starting elevations on Hebron Tributary.

For streams studied by approximate methods, the boundary of the 100-year flood was developed from normal depth calculations, topographic maps (Reference 9) and field observations.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps at a scale of 1:24000, with a contour interval of 10 feet (Reference 9). The 500-year and 100-year flood boundaries are close together, therefore, only the 100-year boundary has been shown.

For the streams studied by approximate methods, the boundary of the 100-year flood was delineated on the topographic maps referenced above.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases

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flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The SCS floodway computer program was used to make the computations (Reference 10). The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map, the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown. The South Fork Licking River floodway lies outside the corporate limits of Hebron.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

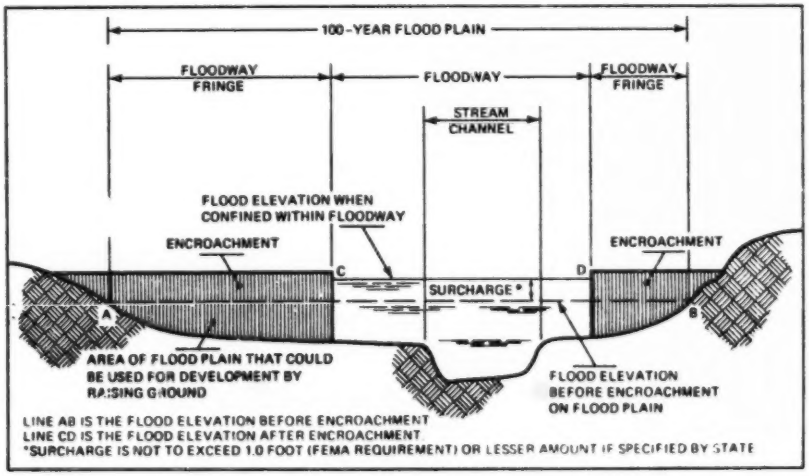
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
HEBRON TRIBUTARY							
A	2600	31	180	4.2	883.5	882.5	1.0
B	4170	90	392	1.9	886.6	885.6	1.0
C	5100	61	195	2.3	888.6	887.6	1.0
D	5980	139	599	0.8	888.9	887.9	1.0

[1]FEET ABOVE CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF HEBRON, OH
(LICKING CO.)

FLOODWAY DATA

HEBRON TRIBUTARY

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the Village of Hebron.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 per cent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the Village of Hebron are shown on the Flood Profiles and are summarized in Table 3, "Flood Insurance Zone Data."

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Village of Hebron was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zones A2 and A3:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Village of Hebron is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

A Flood Insurance Study for the Unincorporated Areas of Licking County is currently in progress (Reference 8). The study includes the South Fork Licking River both upstream and downstream of Hebron. The results of this study will match exactly the Village of Hebron study.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
SOUTH FORK LICKING RIVER							
REACH 1[4]	0001	–1.4	–0.4	1.0	015	A3	VARIES–SEE MAP
HEBRON TRIBUTARY							
REACH 1	0001	–1.2	–0.3	0.6	010	A2	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT
[4]DATA FOR THIS REACH TAKEN FROM LICKING COUNTY, OHIO FIS

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF HEBRON, OH
(LICKING CO.)

FLOOD INSURANCE ZONE DATA

SOUTH FORK LICKING RIVER - HEBRON TRIBUTARY

A Flood Hazard Boundary Map has been published for the community (Reference 11). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 300 South Wacker Drive, (24th Floor), Chicago, Illinois 60606.

8.0 REFERENCES AND BIBLIOGRAPHY

1. State of Ohio, Department of Economic and Community Development, Federal Census Report, April 1980.

2. ————————, Department of Natural Resources, Bulletin No. 35, Floods of January-February 1959 in Ohio, Columbus, Ohio, May 1961.

3. U.S. Department of Agriculture, Soil Conservation Service, Watershed Plan and Environmental Impact Statement for South Fork Licking River Watershed, Licking, Perry and Fairfield Counties, Ohio, June 1980.

4. ————————, Technical Release No. 20, Computer Program for Project Formulation, Hydrology, May 1965.

5. State of Ohio, Department of Natural Resources, Bulletin No. 45, Floods in Ohio, Columbus, Ohio, May 1977.

6. U.S. Water Resources Council, Bulletin No. 17A, Guidelines for Determining Flood Flow Frequency, Washington, D.C., revised June 1977.

7. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 61, WSP-2 Water-Surface Profile Program, A Computer Program for Project Formulation, Hydraulics, May 1976.

8. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Licking County, Ohio, (in progress).

9. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Millersport, Ohio, 1972; Thornville, Ohio, 1975.

10. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 64, Floodway Determination Computer Program, Glenn Dale, Maryland, June 1978.

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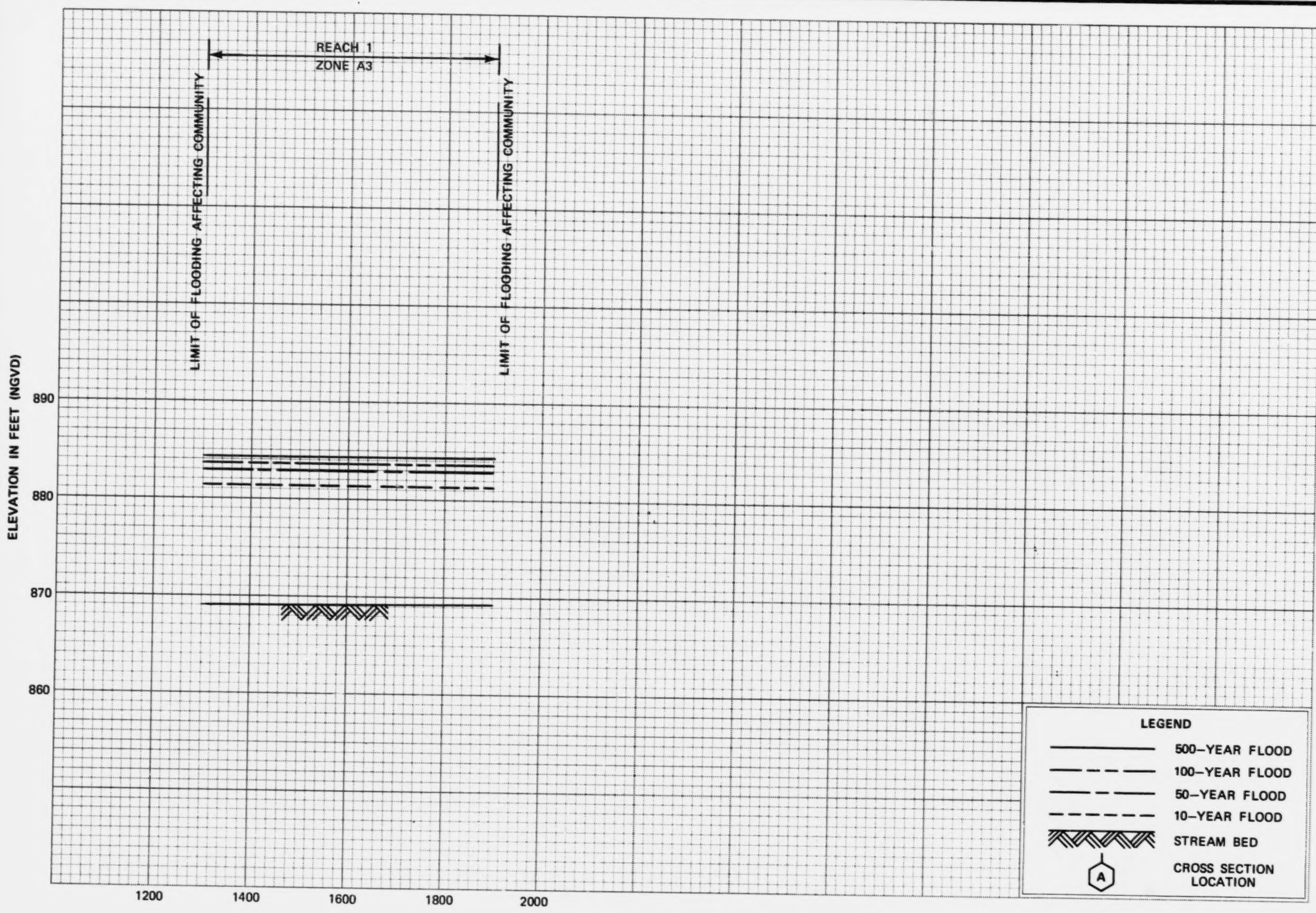

FLOOD PROFILES

SOUTH FORK LICKING RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF HEBRON, OH
(LICKING CO.)

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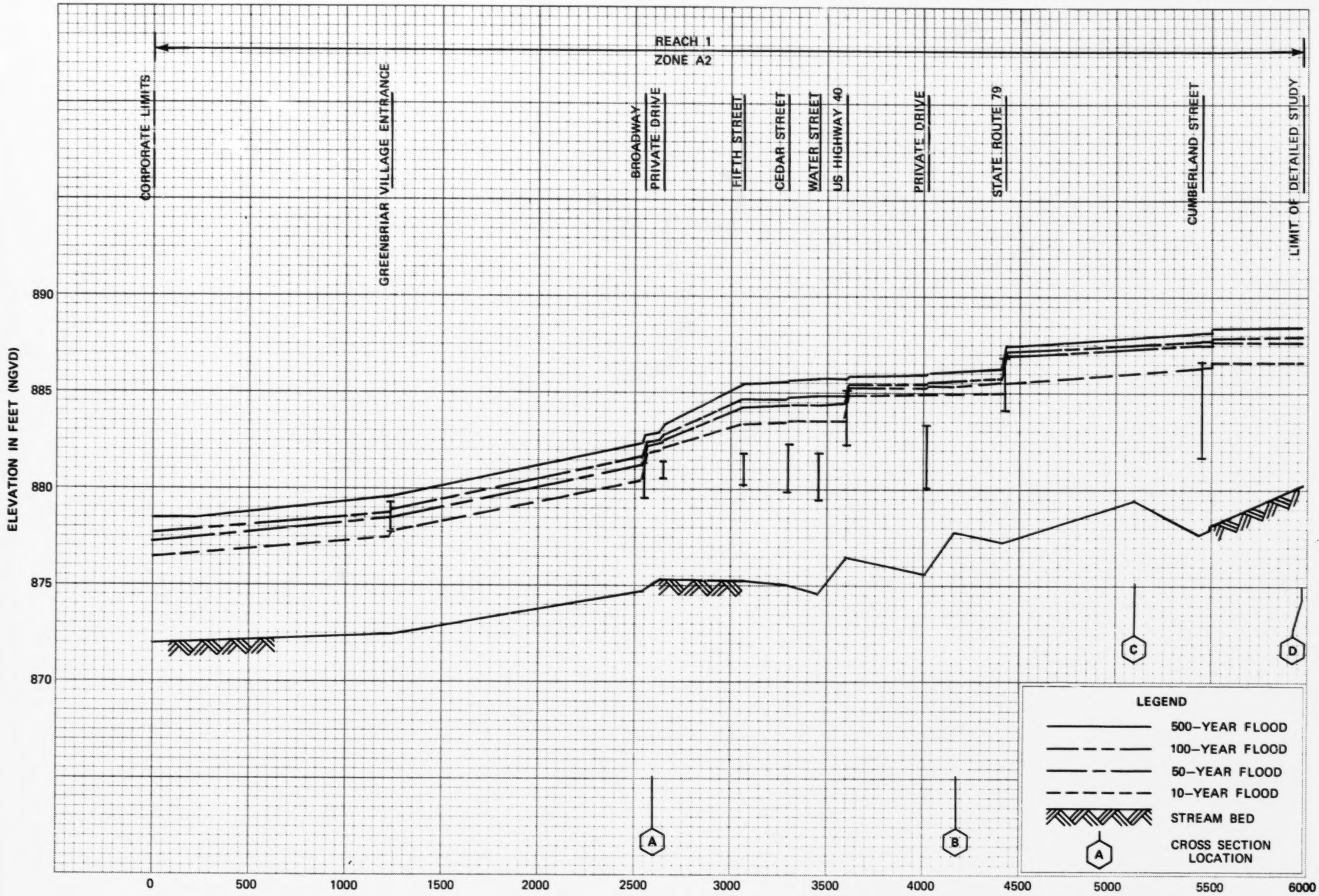

FLOOD PROFILES

HEBRON TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF HEBRON, OH
(LICKING CO.)

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